Scaling properties of magnetic reconnection

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Magnetic reconnection is a universal process in space plasmas, which often dominates the magnetic topology of the system and the flow patterns within and around it. This process is operative in systems with vastly different spatial scales such as the Sun, planetary magnetospheres and at comets. In addition, magnetic reconnection operates on plasma scales ranging from those associated with kinetic electrons and ions to fluid and macro-scales. A true knowledge of the magnetic reconnection process requires the understanding of the minimum spatial scales at which it can be operative and how its properties scale with the system size. Without such an understanding, it is not possible to apply our knowledge of reconnection to systems with various sizes and properties. In this talk, we examine the scaling properties of reconnection using results of global hybrid simulations (kinetic ions, fluid electrons) of solar wind interaction with magnetic dipoles of various strength. Focus is on dayside reconnection during purely southward interplanetary magnetic field direction. The parameter Dp defined as the standoff distance of the nose magnetopause normalized to solar wind ion skin depth is used to characterize the nature of the resulting magnetosphere as a function of dipole strength. It is found that magnetic reconnection (generation of reconnection electric field) and the associated plasma jetting first occur at small values of Dp ($\sim$2) before a terrestrial like magnetosphere is formed. Further evolution of this process is observed with increasing values of Dp. We classify and present this evolution in terms of the variation of the reconnection rate, plasma jetting speeds and spatial scales associated with single and multiple x-lines formed in the process.